TASK 3.1
ASSESS PLANNING HORIZON IMPLICATIONS

By
Planning and Zoning Center Inc.

TASK DESCRIPTION IN LAKE MICHIGAN POTENTIAL DAMAGES STUDY DELIVERY ORDER SCOPE OF WORK;
PHASE 3, FISCAL YEAR 1999 (as modified in April 1999)

Under this task, the Contractor will be required to assess the implications of using a 50-year planning horizon on the relevant uses of the potential damage estimates for the ~~five~~ two prototype counties. Selection of a 50-year value for estimating anticipated future losses heretofore has been arbitrary. Considerable debate can occur about the legitimacy of forecasting economic conditions even beyond 4-5 years into the future, although public investments in hazard damage reduction require reasonable estimates of annualized benefits/disbenefits over a longer future time span. Local economic decision-making is highly susceptible to regional, national and even international factors. Land use trends, construction of shore protection and changes in riparian uses all can significantly affect the reliability of estimates of benefits/disbenefits. The life-span of structural protection measures also varies considerably by type. The degree of maintenance on these structures can profoundly impact economic estimates. Land use management practices, such as setback restrictions, vary considerably from state-to-state and over time.

The Contractor will investigate the implications of using a particular time horizon on the utility of the economic estimates for all inevitable uses. The Contractor will generate a summary report that includes observations, conjectures, and issues of debate that may be an important factor if further analyses are needed study.

Purposes of Task 3.1

The principal purposes of this task include:

1. assessing the implications of using a 50 year planning horizon on the relevant uses of the potential damage estimates for the two prototype counties
2. identifying other planning horizons and comparing the implications of using them to the implications of using a 50 year planning horizon
3. recommending a planning horizon

In order to accomplish these purposes, it is necessary to:

- identify the principal uses of the potential damage estimates
- identify the principal uses of the planning time horizons

- create a simple model of the land uses along the Lake Michigan shoreline and likely structural and nonstructural responses by property owners and governments to extended high and extended low water levels

Principal Uses of the Potential Damage Estimates

The phrase "potential damage estimates" refers to calculations of economic damage that may occur from a variety of lake level situations over a period of time. As a practical matter, the continuum of potential lake level combinations (high, low, average, or alternating high and low), will most often only create a severe damage situation if there is: 1) a sustained period of either high or low lake levels, 2) a rapid shift from a prolonged period of low-to-high or high-to-low levels, or 3) a period of many severe storms at any lake level. [Hereafter, this set of three potentially severe lake level situations is simply referred to as a "sustained or prolonged period of high or low lake levels".] Severe damage potential is presently of great concern because of the current low lake level and the memory of high levels only a few years ago.

In order for potential damage estimates to be of much value, they must relate to a range of responses to high and low lake level situations. In this way, the information on potential damages will be available to be used as a key decision input or variable in formulating measured responses to a period of prolonged high or low lake levels. The situation may be best understood by use of a simple model of the key players and their likely actions in response to lake level changes. See Appendix A for a brief description of such a model.

Identifying the widest range of potential uses of the potential damage estimates requires also identifying potential audiences that would be interested in the information. Listed below are a range of audiences likely to be interested in potential damage estimates and what their interest (or use) of the information would likely be.

<u>Government (elected and administrative)</u>

Federal -

- Congress & the White House (budget, policy and regulatory interest)
- The Army Corps of Engineers (planning, budgeting, policy and regulatory interest)
- EPA (planning, budgeting, policy and regulatory interest)
- FEMA (planning, budgeting, policy and regulatory interest)

State -

- Lawmakers (budget, policy and regulatory interest)
- Dept. of Environmental Quality (planning, budgeting, policy and regulatory interest)

Local (city, village, township and county)

- Elected officials (budget, policy and regulatory interest)
- Zoning and building officials (regulatory interest)

- Professional planners and planning commissioners (planning, policy and regulatory interest)
- Tax assessors (tax assessing interest)

Riparians and Floodplain Owners

- Lake Michigan shoreline landowners will have interests that may differ depending on the land use and its orientation to or dependency on the water. The most common land use along the Lake Michigan shoreline is single family residential. Other land uses include: multiple family residential, commercial, industrial, institutional (government buildings and churches), parks and recreation, utilities, transportation facilities, and agricultural. The impacts of prolonged periods of high water are likely the greatest concerns of this group.
- Rivermouth floodplain landowners and landowners in low-lying areas along the Great Lakes often include many more nonresidential land uses than residential and, have generally smaller lots with less depth than other lots along the Lake Michigan shoreline. Prolonged periods of low water are often the greater concern to the portion of this group that is riparian, while prolonged periods of high water are often the greater concern of owners of other flood-prone property.
- These landowners have interests that may be expressed individually or as organized groups.

Shore Protection Dealers

- This category incorporates the range of parties who design, sell, supply, install and/or repair shore protection. This group will be interested in the information on damage potential as a predictor of potential market size and to use in marketing their products and services.

Boaters

- This large group of recreationists (and the dealers, suppliers and maintenance companies that support them), depends on being able to easily get their boats into and out of the water. Prolonged periods of either high or low water can greatly disrupt this.

Realtors & Developers

- These parties will be interested in potential damage information because it may enhance or detract from the way they typically market their services and products. It may open some niche markets, and may affect the way they buy, sell or develop property.

Policy Wonks

- This is the growing cadre of academics, private and nonprofit firms that study Great Lakes and related issues, and advise their clients or constituencies on appropriate courses of action. Their interests will range from staying abreast of contemporary thinking on the subject, to providing support to groups that

advocate a particular point of view or policy position on Great Lakes levels and/or damage potential.

Environmental Organizations

- These are nonprofit advocacy organizations and their members who strive to maintain the integrity of natural systems and to prevent pollution of the Great Lakes. The principal interest of these groups in potential damages information will likely focus on use of the information to support their environmental protection policy positions.

Business Organizations

- These are local chambers of commerce, downtown development or redevelopment organizations that promote new business development, retention of existing businesses and redevelopment of business areas. Their interest will likely focus on how potential damages may result in net declines of business and businesses in an area.

Citizens in General

- These are interested persons who do not fit into one of the above categories, but who stay somewhat informed on issues of local interest and periodically vote for elected officials and on ballot measures based on their beliefs or knowledge about an issue or candidate.

With these potential audiences in mind, the likely "inevitable uses" of potential damages information fall into two main categories: 1) planning, budgeting, policy and regulatory uses; and 2) potential costs to shoreline and floodplain owners.

In the planning, budgeting, policy and regulatory uses arena, potential damage estimates would be a key piece of information to consider when formulating or evaluating proposals to:

- Install shore protection at public expense along especially, long stretches of shorelines
- Change regulations to permit broader installation of private shore protection
- Adopt new regulations concerning building setback or moving structures at high risk from erosion of the shoreline
- Regulate lake levels so as to prevent long periods of high or low levels
- Dredge channels and harbors when lake levels are low
- Replace or reconstruct key public facilities, like roads, damaged or closed by erosion caused by high lake levels
- Consider shoreline and floodplain property purchases as an alternative to either structural or regulatory alternatives.

Most of the rest of the interest in estimated damages information will come from existing or potential property owners (or to persons providing information or other services to them) who will want to know potential costs so that:

- Existing shoreline or floodplain owners can make an informed choice on whether to: try to build shore protection, relocate structures farther away from the bluff, or sell the property
- Potential shoreline or floodplain owners can make an informed choice as to whether to: buy property facing the uncertainties and risks associated with natural fluctuations in lake levels.
- Designers and sellers of shoreline protection products and services will be interested in using the information to best craft their products and services.

Potential Uses of the Planning Time Horizons

In order to evaluate the implications of continuing to use a 50-year time horizon for potential damage estimates, it is important to consider the host of time frames inherent in other aspects of such an analysis. It is also important to consider the time frames of interest to various users. Time frames are used to:

- Project potential variation in the lake levels using a geologic time frame: 10,000 years. Use of geologic data helps refine understanding and context for use of the 150 years of lake level data. However, 10,000 years is so long that it is hard for all but a few experts to understand and is outside the scope of understanding of most citizens.
- Project lake level variation based on existing data: 150 years. In order to create a model that reasonably predicts the potential for lake level variation, 150 years of lake level data is used along with geologic records to hypothesize potential high or low lake levels.
- Establish the engineering design life of large-scale water resources projects: 50 years. The Army Corps of Engineers typically evaluates project costs and benefits so that any facilities or programs recommended in a particular large-scale water resources project are in place for a 50-year period.
- Project land use change along the shoreline and in floodplains: 10 - 30 years. Local master plans usually rely on a future land use time frame of twenty to thirty years with periodic updates at 5 - 10 year intervals. There are many reasons for this including: the rare availability of good data older than that; the inability of most communities to look beyond that (or even care beyond that); and the need for an area to build out enough to be able to meaningfully talk about the impacts of land use changes in the area. Projections for shorter time frames (usually in five-year increments) are also common.
- Predict property owner responses to varying high or low lake levels: 1 - 10 years. A sustained period of high or low lake levels will result in significant actions by property owners. These could range from investing in shore or flood protection, to moving the house back, elevating it from predicted flood levels, to selling the property and moving elsewhere. Not everyone will act at once in response to the same circumstances, and not everyone will act in the same manner. Some will act more than once, some will not act at all. Public land managers may act differently than private interests. But if the period under evaluation is either a sustained period of highs or lows, or a significant shift from a prolonged low to a prolonged high, or is following a series of

severe storms, then most shoreline or floodplain property owners will likely take one or more significant actions within 5 years and the balance within 10 years. Otherwise they will risk substantial or total loss of property value.

- During periods of prolonged high or low lake levels, public entities will be under significant pressure to either spend money on shore protection, dredging, or controlling lake levels, or to increase regulations (as an alternative to structural solutions), or to do some combination of all of the above. The extent of the threat of damage, and the potential costs of remediation, will determine the amount of pressure on public entities to act. If past responses to natural threats are any guide, a one-to-five year period for action is most likely, with additional refinements in the approach within the next five years.

Whatever time frame is selected for the potential damage estimates, it should be sensitive to the above parameters. That will likely require greater detail in cost estimates for the early years of the damage calculation, yet the period must also be long enough to consider land use change and likely property owner response over time. At the same time, the period should not be so long that it has no relationship to practical considerations inherent in property ownership/management and long term use of the land. These practical considerations include the period for which detailed data has been available, the average life of structures, typical mortgage lengths and the declining confidence (increasing risk) associated with projections more than five years in the future.

Implications of Using a 50-year Planning Horizon

Previously, a 50-year time horizon has been used for calculating potential damages from prolonged high or low lake levels. This period appears to have been arbitrarily selected. It conforms to standard Army Corps of Engineers protocol that calls for the use of 50- and 100-year time frames for cost/benefit studies. However, past studies have sometimes been severely criticized for using such long time frames. One advantage of a long time frame is that small economic benefits compounded over many years add up to large benefits. Conversely, even small economic costs can become huge when compounded over a 50-year period (especially if a discount rate is used as described below). Depending on the outcome of the analysis, this can result in arguing strongly for the option with big positive future benefits. There are two big problems with such an approach. First, the level of confidence that can be placed in economic projections often begins to fall off rapidly after five years. Second, as a practical matter, it is difficult to get investors (existing or potential property owners) or politicians to take an action with a big long-term benefit and a high initial cost (fiscally or politically).

The discount rate used to calculate the time value of money is also important because of its sensitivity to the time frame. In order to equate a future time with the present, projections of future costs or benefits are often expressed in terms of

net present value. A discount rate is used to convert future dollars into equivalent net present dollars. There is an inherent bias in the use of long time frames with discount rates. The longer the time frame, the greater the net present benefit because of the longer period over which to amortize costs and the effect of the discount rate on present value over the long period. This results in a bias toward expensive projects where the resources are available to construct them in the first place. The shorter the time frame of the projected costs, the less the bias inherent in the use of a discount rate to calculate net present value. [See for example Raleigh Barlowe, **Land Economics**, 1972, p. 206-218.]

On the other hand, many common natural resources have a value that far transcends the near future, if they are managed for the benefit of present and future generations. Few natural resources exceed the value of the Great Lakes in this regard. Decisions to protect this resource, the land that surrounds it, and the population that depends upon it must be made within time frames whose vision registers in the thousands of years in the future.

In this context, the use of a 50-year planning horizon is short for a resource like Lake Michigan and is within the sphere of existing projection capabilities, but it is outside typical confidence levels--especially when discount rates are applied for that long. A 50-year period also does not fit neatly with practical considerations inherent in property ownership/management. Other time frames, especially those that project costs at various time intervals, rather than for every year on a time continuum may offer more practical utility, a higher confidence level in the early years and still preserve a long term view.

Other Planning Horizon Options

An examination of other time frames used when examining Lake Michigan and similar resources reveals a range from 5 to 500 years. For example:

- Shoreline landowners often look to amortize their investment in property or improvements (including shore protection, floodproofing or relocation on the site to avoid hazards) in terms of their anticipated ownership period. This is often 5-20 years, but could be shorter or longer for some owners.
- FEMA commonly uses 10-, 50-, 100-, and 500-year time horizons for floodplain and storm event calculations.
- The Michigan Department of Environmental Quality uses 30- and 60-year periods for calculation of minimum setbacks for properties in designated high-risk erosion areas. The 30-year period was originally selected because the air photos available to measure erosion rates from, spanned about 30 years, and because most mortgages at that time (early 1970's) were for 30 years. This was also the period of time the IRS commonly used to amortize the investment in a property for depreciation purposes. The then DNR, also examined a study by HUD prepared in the early 1970's that showed the average life of structures in the Midwest ran from 75-100 years. Calculations of setbacks based on a 75- or 100- year time frame were felt to be too great

for either political or practical application (many lots were not deep enough to accommodate a structure if a setback based on 75- or 100- years was used). In 1994? This time period was extended to 60-years for two reasons. First, because more recent air photos showed more rapid rates of erosion and the DEQ wanted property owners to have an erosion benchmark considerably greater than 30 years. Second, because one other state, North Carolina, had similarly settled on both a 30- and a 60-year time frame for its coastal erosion regulations. Sixty years is also a multiple of 30 years. Minimum high-risk erosion area setbacks in Michigan are now calculated in both 30- and 60-year increments. It is believed that the bulk of the useful life of a new structure built today, will be captured within a 60-year period. This is another justification for the current standard.

- As of 1990, three other states use a 30-year period to establish erosion setbacks, one state uses a 30-40 year period, and two states use a 50-year period (according to an inventory in **Managing Coastal Erosion**, National Academy Press, Washington, D.C.). See Appendix B, for Table 5-1 from **Managing Coastal Erosion**.
- As mentioned earlier, time periods used for land use projections in local master plans tend to be 20-30 years.

It appears there is a wide variability across the nation in the time periods used to deal with coastal erosion and floodplains. Listed below are a range of time period options based on the above information. Except for the last two options, which are fixed-point time frames, all the others are ranges:

- Very short time frame (1-5 years)
- Short time frame (5-15 years)
- Medium time frame (15 - 30 years)
- Long time frame (30 - 60 years)
- Very long time frame (over 60 years)
- One fixed time frame (50 years)
- Combination of fixed points in time.

Implications of Using other Planning Horizon Options

Listed briefly in Table 1 are some of the pros and cons of each of the planning horizon options listed above relative to likely applications of the potential damages information by various users of the information. The pro and con responses indicated are conjectured based on broad experience with the two principal user groups (government officials and shoreline property owners). If the responses indicated are anywhere close to accurate, it is apparent that from the perspective of different users of potential damage estimates, some time frames have greater utility than others do. Yet as the last column of Table 1 demonstrates, to accommodate the needs of most users and uses of potential damage estimates, a range of time periods, or several points in time across the entire time continuum are needed. For example, the results could be listed in a variety of ranges. One option is the five ranges listed above and on Table 1: 1-5

years, 5-15 years, 15-30 years, 30- 60 years and more than 60 years. A simpler approach is to use three ranges: near term damages (1 - 5 years), mid-length damages (20 - 30 years), and long term damages (50 - 60 years). Or, alternatively, the results could be listed for a particular year, such as year 5, year 25, or year 50.

Three or five sets of estimates is small enough to easily communicate the results of two to five lake level scenarios. However, the annual damage estimates for all years in a continuum of at least 1-60 years for each scenario will need to be available to meet the needs of the widest range of users. Some users will want to aggregate the results for different ranges than can be accommodated in a short, medium and long range. To prevent confusion in presentation of damage estimates, the short, medium and long term estimates could be published in the main report and estimates for every year could be published in an Appendix.

Recommendations

It is recommended that a time frame be selected that meets most users needs. This is either a short term (1-5 years), medium term (20 - 30 years) or long term, or as a fixed point on this interval (5, 25 and 50 years) as described in the paragraph above. However, two caveats are important. First, the projections need to be presented with a clear indication of the declining confidence level the farther the estimates are projected into the future. Second, if the information is presented in a cost/benefit context, there needs to be a clear indication of the discount rate used and the bias effect it has the longer the term of the projections. If these cautions aren't heeded, the projections could be easily misinterpreted and would be easy to use in a misleading way.

This recommendation does present challenges for structuring the damage estimate calculations and for displaying the results in an easy-to-read and understand fashion. However, the reward for doing so is broader utility of the results to a wider set of stakeholders with less confusion than in the past.

Suggestions for Further Study

None of the likely responses of stakeholders presented in this analysis is the result of survey information or a literature review of prior research. As a result, intelligent, informed persons could disagree on presumed responses. Only additional research could validate the conjectured responses. However, if the premises underlying the presumed responses in Table 1 are widely accepted, then whether all the responses indicated are completely accurate is irrelevant, since the purpose is to demonstrate that different users of the damage estimates have different uses for the information and that different time frames are associated with those uses. The benefit of additional research would be in the area of specific intervals to use for presenting the results. Presenting the potential damage estimates to different stakeholders and measuring their

responses can easily test various intervals. This could be accomplished in a cursory fashion in the upcoming focus groups.

Another area for debate and future research is how many (and what combination of factors of) sustained low or high lake level scenarios must potential damage estimates be prepared for (with the time frames agreed upon), in order to meet the wide variety of needs of the many different stakeholders. The most valuable information for particular users may not be damage estimates for one or two situations at particular points in time, but rather a range of costs for a range of lake level situations over time. If each scenario were associated with probability information, it would be easiest to assess (from different perspectives) which was of most concern. If this was refined further to reflect potential damage estimates under each of the situations listed in the first column of Table 1, then the results would have the greatest utility for all users. It would lead to better informed decision making after considering a range of possible responses to sustained high or low lake levels. Better public policy and better individual property owner decisions should be the result.

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Table 1
PROS AND CONS OF VARIOUS TIME FRAMES FOR POTENTIAL DAMAGE ESTIMATE USES

Note: that the pros and cons on the table below are only a sampling of possible responses from users of potential damage estimates information. Generally the biggest pro or con for a particular user of the information is listed. Preference is given to shoreline landowners and government officials as the principal users of the information.

	Very short time frame (1-5 years)	Short time frame (5-15 years)	Medium time frame (15 - 30 years)	Long time frame (30 - 60 years)	Very long time frame (over 60 years)	One fixed time frame (50 years)	Combination of fixed points in time
Planning, budgeting, policy and regulatory uses							
Install shore protection	**Pros**: highest accuracy **Cons**: benefit period is short	**Pros**: still within common reference **Cons**: longer than term of office	**Pros**: fits many amortization periods **Cons**: doesn't really match many existing time frames	**Pros**: fits typical amortization periods; long benefit period **Cons**: hard to relate to for most users	**Pros**: lowest accuracy; long benefit period **Cons**: hard to relate to	**Pros**: simple **Cons**: hard for property owners, taxpayers and politicians to relate to	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Change regulations to permit more private shore protection	**Pros**: likely stimulate political support for this option **Cons**: doesn't factor in implications of failure of shore protection	**Pros**: likely stimulate political support for this option and is long enough to factor in failure of systems **Cons**: still too short for	**Pros**: lengthens period to show economic benefits **Cons**: still too short for calculating long term effects of shore	**Pros**: long enough for calculating long term effects of shore protection **Cons**: may "set-up" future regulators and property	**Pros**: long enough for calculating long term effects of shore protection **Cons**: may "set-up" future regulators and property	**Pros**: simple, long enough for calculating long term effects of shore protection **Cons**: may "set-up" future regulators and property	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables

	because time frame is too short	calculating long term effects of shore protection	protection	owners with legacy of property damage due to permissive regulations	owners with legacy of property damage due to permissive regulations	owners with legacy of property damage due to permissive regulations	
Adopt new regulations concerning building setback or moving structures	**Pros**: likely to raise citizen awareness substantially **Cons**: too short to stimulate political support for this option	**Pros**: likely to stimulate political support for this option **Cons**: vocal shoreline property owners may object to increased regulation or organize political opposition	**Pros**: likely to stimulate political support for this option **Cons**: vocal shoreline property owners may object to increased regulation or organize political opposition	**Pros**: benefits likely to be easy to show **Cons**: too long for most citizens to identify with	**Pros**: benefits likely to be easy to show **Cons**: too long for most citizens to identify with	**Pros**: benefits likely to be easy to show **Cons**: too long for most citizens to identify with	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Regulate lake levels	**Pros**: appears to be an immediate fix **Cons**: long term environmental and economic implications not apparent; international agreements difficult	**Pros**: appears to be an immediate fix **Cons**: long term environmental and economic implications not apparent	**Pros**: long enough to show problems with this approach **Cons**: perhaps not long enough for impacts to be definitive	**Pros**: : long enough to show problems with this approach **Cons**: confidence level in results may be very low	**Pros**: long enough to show problems with this approach **Cons**: confidence level in results may be very low	**Pros**: benefits likely to be easy to show **Cons**: too long for most citizens to identify with	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Dredge channels and	**Pros**: likely stimulate	**Pros**: likely stimulate	**Pros**: lengthens	**Pros**: long enough for	**Pros**: long enough for	**Pros**: simple, long enough	**Pros**: fits many users info needs

harbors	political support for this option **Cons**: doesn't factor in implications of long term costs of continued dredging because time frame is too short	political support for this option and is long enough to factor in repeated dredging costs **Cons**: still too short for calculating long term implications of regular dredging	period to show economic benefits **Cons**: still too short for calculating long term costs	calculating long term costs and natural effects of dredging **Cons**: confidence level in results may be very low	calculating long term costs and natural effects of dredging **Cons**: confidence level in results may be very low	for calculating long term effects of shore protection **Cons**: too long for most citizens to identify with	**Cons**: may be more complicated to keep track of calculations and to present in tables
Replace or reconstruct key public facilities	**Pros**: likely to have accurate costs **Cons**: too short to be confident of long term benefits	**Pros**: likely to have accurate costs **Cons**: too short to be confident of long term benefits	**Pros**: long enough to determine if benefits are worth the costs **Cons**: many costs likely to be so high that inaction results	**Pros**: long enough to determine if benefits are worth the costs **Cons** many costs likely to be so high that inaction results	**Pros**: long enough to determine if benefits are worth the costs **Cons**: confidence level in results may be very low	**Pros**: simple **Cons**: confidence level in results may be very low	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Public purchase of threatened shoreline and floodplain property	**Pros**: magnitude of the problem and implications will be clear **Cons**: too short to justify costs	**Pros**: magnitude of the problem and implications will be clear **Cons**: too short to justify costs	**Pros**: magnitude of the problem and implications will be clear **Cons**: too short to justify costs	**Pros**: long enough to justify costs **Cons**: too short to justify costs	**Pros**: long enough to justify costs **Cons**: too short to justify costs	**Pros**: simple, long enough to justify costs **Cons**: too short to justify costs	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables

Existing or potential property owners							
Make an informed choice on whether to build shore protection, relocate structures farther away from the bluff, or sell the property	**Pros**: immediate relevancy **Cons**: not long enough to amortize investment	**Pros**: relevant to most shoreline owners **Cons**: not long enough to amortize investment	**Pros**: long enough to amortize investment **Cons**: outside time frame for many shoreline owners	**Pros**: may be ok if land values continue to stay high and extended high or low water period goes away **Cons**: too long for most first-time shoreline owners to be willing to amortize investment	**Pros**: may be ok if land values continue to stay high and extended high or low water period goes away **Cons**: too long for most shoreline owners	**Pros**: may be ok if land values continue to stay high and extended high or low water period goes away **Cons**: too long for most shoreline owners	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Make an informed choice as to whether to buy or develop property facing the uncertainties associated with natural fluctuations in lake levels.	**Pros**: data leads to increased awareness **Cons**: period is probably too short for most prospective buyers	**Pros**: period is about right for most prospective buyers **Cons**: not long enough to amortize investment	**Pros**: period is right for long term buyers **Cons**: cost figures may not be accurate enough	**Pros**: period is right for loans on new construction **Cons**: time frame is too long for many and cost figures probably have too low a confidence level	**Pros**: period is ok for many lenders **Cons**: time frame is too long for many and cost figures probably have too low a confidence level	**Pros**: period is ok for many lenders **Cons**: time frame is too long for many and cost figures probably have too low a confidence level	**Pros**: fits many users info needs **Cons**: may be more complicated to keep track of calculations and to present in tables
Using the information to	**Pros**: period fits most	**Pros**: time period still	**Pros**: data useful when	**Pros**: data useful when	**Pros**: period is ok for many	**Pros**: period is ok for many	**Pros**: fits many users info needs

best craft the products and services of realtors and developers	prospective uses **Cons**: period is probably too short for most prospective uses	useful **Cons**: period too long for some uses	working with lenders **Cons**: time period is too long to matter for marketing	working with lenders **Cons**: time period is too long to matter for marketing	lenders **Cons**: time period is too long to matter for marketing	lenders **Cons**: time period is too long to matter for marketing	**Cons**: may be more complicated to keep track of calculations and to present in tables

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APPENDIX A

Simple Model
(To be refined further if it appears to be useful, is easy to cut if it isn't useful)

Define simple model of the land uses along the Lake Michigan shoreline and likely structural and nonstructural responses by property owners and governments to extended high water levels and extended low water levels. Key actors are:

- Shoreline residential landowners
- Shoreline nonresidential landowners
- Floodplain residential landowners
- Floodplain nonresidential landowners

Ignore differences between high and low bluffs and between different types of nonresidential development

Assumed market trends: rising property value, fixed quantity resource (property near Lake), high demand for waterfront property will force conversion from low to high value structures--good opportunity for nonstructural responses, but wealth of owners likely to result in willingness to pay for shore protection as long as it doesn't exceed x% of the value of the property, and if moving back is not economically feasible
Likely responses (should be detailed separately for shoreline and floodplain owners and whether they are residential or nonresidential uses):

- moving structures, or installing shore protection on prolonged high water levels in both shoreline and floodplain areas
- unwillingness to support above measures as new regulations during a period of prolonged low water along shoreline
- demand for public dredging and regulation of lake levels during periods of prolonged low water in floodplain areas
- demand for regulation of lake levels during periods of prolonged high water in both shoreline and floodplain areas.

APPENDIX B

Insert Table 5-1 from **Managing Coastal Erosion**